

APPLIED RESEARCH LABORATORIES

THE UNIVERSITY OF TEXAS AT AUSTIN

P. O. Box 8029 • Austin, Texas 78713-8029 • (512) 835-3200 • FAX: (512) 835-3259

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5 February 1993  
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TL-SP-93-02

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Office of Naval Research  
Applied Research Division  
800 North Quincy Street  
Arlington, VA 22217-5000

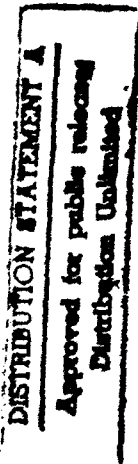
ATTN: Kam Ng, Code 1222



SUBJ: Final Report on Contract N00014-91-J-1719

This technical letter represents the final report on contract N00014-91-J-1719. The objectives of this program were to quantify the detection performance of higher order spectral processing methods for full beam and dual beam sensor systems and apply these results in two areas: sonar detection using conventional arrays and remote sensing of sound fields using laser Doppler velocimetry (LDV) techniques. The predominant issues are the improvement in detection performance compared to more traditional processing, and the identification and effects of dominant noise sources.

This work builds on work done under previous contracts to specify the statistical properties of various higher-order spectral estimators. The statistical properties were derived for both narrowband and broadband signals, and were based on expected noise fields for both sonar and LDV measurements. Access to data from other programs allowed realistic determinations of the sonar signal and noise fields. We also participated in a structural acoustics program at ARL:UT to further determine signal characteristics. In the case of LDV measurements, both experimental work and computer simulations were conducted under this program to determine the nature of the signal and noise fields as they apply to higher-order spectral processing. Data produced by researchers at Georgia Tech also were analyzed. Wavelet based higher order processing focused on the development of wavelet methods to analyze non-octave proportional bandwidth narrowband harmonics and to analyze mechanically generated transients.



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Summaries of this work were documented in annual letter reports TL-SP-92-29 and TL-SP-91-50 to ONR. In addition, the detailed technical results were published or presented in the following:

Gary R. Wilson and Keith R. Hardwicke, "Non-Stationary Higher Order Spectral Analysis," Applied Research Laboratories Technical Report No. 91-8 (ARL-TR-91-8).

Martin L. Barlett, "Signal Processing Studies of a Simulated Laser Doppler Velocimeter-Based Acoustic Sensor," ARL:UT Technical Report ARL-TR-90-33.

Hinich, Melvin J. and Gary R. Wilson, "Time Delay Estimation Using the Cross-Bispectrum," IEEE Trans. Sig. Proc., 40, Jan. 1992, pp 106-113.

Martin L. Barlett and J. W. Hsu, "Low Frequency Spectral Content and Coherence of Noise in Laser Measurement Systems," Applied Research Laboratories Technical Paper No. 91-3 (ARL-TP-91-3), submitted to the Journal of Applied Optics.

Wilson, G. R., Barlett, M. L., and Hardwicke, K. R., "Detection of Linear Periodically Time Varying Processes Using Higher Order Spectra," Proceedings of the International Signal Processing Workshop on Higher Order Statistics, Chamrousse, France, 10-12 July, 1991.

Sincerely,

Gary R. Wilson  
Signal Physics Group

11-10-91 10:00 AM

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